5450neDr1ve2_00017912

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number
0-1 Amendment 5

[ ] Original [X] Amendment Number:

Contract Number
EP-C-07-028

Contract Period Base

Title of Work Assignment:
Comprehensive Gasoline Light Duty Exhaust Fuel Effects Test Program to Cover Multiple Fuel Properties and Two Ambient Test Temperatures

Contractor

Specify Section and Paragraph of Contract SOW

Purpose: Work Assignment Initiation [] Work Assignment Close-Out
[X] Work Assignment Amendment [] Incremental Funding
[] Work Plan Approval

Periods of Performance
From: Effective Date To: 1/27/2009

Comments:

Amendment to WA 0-1 that clarifies technical issues concerning, the measurement of volatile organic compounds, engine oil sampling, extend analysis of Green House Gases. We anticipate and increase in costs due to this amendment.

[] Superfund **Accounting and Appropriations Data** [] Non-Superfund

Lin	DC (Max 8)	Budget/FY	Appropriation Code (Max	Budget Org/Code (Max 7)	Program Element (Max 8)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period:	Cost/Fee	
This Action		
Total		
Contractor WP Dated :	Cost/Fee:	
Cumulative Approved:	Cost/Fee:	

Ex. 4 - CBI

Work Assignment Manager Constance Hart
Constance Hart (Signature) 3/17/08 (Date)
Branch/Mail
Phone Number 734/214-4340
Fax Number 734/214-4939

Project Officer Name Carl Scarbro
Carl Scarbro (Signature) 3/17/2008 (Date)
Branch/Mail CodeASD
Phone Number 734/214-4209
Fax Number 734/214-4939

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code
Phone Number
Fax Number

Contracting Official Name: Tammy A Thomas
T. Thomas (Signature) 3/19/08 (Date)
Branch/Mail Code CPOD
Phone Number 513/487-2030
Fax Number 513/487-2109

Contractor Acknowledgement of Receipt and Approval of Workplan *(Signature and Title)* Date

EPA Form 1900-69 (Rev. 07-95)

Performance Work Statement

Contract EP-C-07-018	Work Assignment Number 01 Amendment 5
Issuing Office	Environmental Protection Agency 2000 Traverwood Drive Ann Arbor, MI 48105-2498
Contractor	Southwest Research Institute 6220 Culebra Rd. San Antonio, TX 78228-0510
Title	Comprehensive Gasoline Light Duty Exhaust Fuel Effects Test Program to Cover Multiple Fuel Properties and Two Ambient Test Temperatures

The following tasks are changed as follows. All other items/tasks remain per amendment 4.

Task 1 Work Plan Development

Submit a work plan as per previous amendments.

Task 3 Vehicle Recruitment

Table 3-1 is changed as follows. All other items in task 3 remain the same.

Table 3-1. Test Vehicles for Recruitment

Make	Year	Brand	Model	Engine	Family	T2 Bin	Note
GM	2008	Chevrolet	Cobalt	2.2L I4	8GMXV02.4025	5	
GM	2008	Chevrolet	Impala FFV	3.5L V6	8GMXV03.9052	5	FFV
GM	2008	Saturn	Outlook	3.6L V6	8GMXT03.6151	5	
GM	2008	Chevrolet	C 1500 Silverado FFV	5.3L V8	8GMXT05.3373	5	FFV
	2008						
Toyota	2008	Toyota	Corolla	1.8L I4	8TYXV01.8BEA	5	
Toyota	2008	Toyota	Camry	2.4L I4	8TYXV02.4BEA	5	
Toyota	2008	Toyota	Sienna	3.5L V6	8TYXT03.5BEM	5	
Toyota	2008	Toyota	Tundra	4.0L V6	8TYXT04.0AES	5	
	2008						
Ford	2008	Ford	Focus	2.0L I4	8FMXV02.0VD4	4	
Ford	2008	Ford	Taurus	3.0L V6	8FMXV03.5VEP	5	
Ford	2008	Ford/Mercury	Explorer	4.0L V6	8FMXT04.03DB	4	
Ford	2008	Ford	F150 FFV	5.4L V8	8FMXT05.44H2F	8	FFV
	2008						
Chrysler	2008	Dodge	Caliber	2.4L I4	8CRXB02.4MEO	5	
Chrysler	2008	Dodge/Chrysler	Caravan FFV	3.3L V6	8CRXT03.3NEP	8	FFV

Chrysler	2008	Jeep	Liberty	3.7L V6	8CRXT03.7NE0	5	
	2008						
Honda	2008	Honda	Civic	1.8L I4	8HNXV01.8LKR	5	
Honda	2008	Honda	Accord	2.4L I4	8HNXV02.4TKR	5	
Honda	2008	Honda	Odyssey	3.5L V6	8HNXT03.54KR	5	
Nissan	20082007	Nissan	Altima	2.5L I4	8NSXV02.5G5A	5	

Task 4 Test Fuels and Lubricants is changed as follows.

Engine lubricants for this program will be provided by the EPA. They will meet the manufacturer's recommended specifications contained in the owner's manuals. The contractor shall inform the EPA WAM of the volume of lubricant needed in each viscosity grade.

The contractor shall procure and maintain all test fuels for this program. Detailed specification of these fuels is provided in Appendix A.

The test fuels shall be blended exclusively from refinery components and cuts of refinery components. Special chemicals and chemical blendstocks shall not be used. However, butane and benzene may be used to adjust RVP and benzene content of these fuels, respectively. The distillation properties of the test fuels shall meet the following requirements:

- The segments of distillation curves between T10 and T50 shall either be straight lines or slightly convex
- The segments of distillation curves between T50 and T90 shall be concave
- T90 minus T80 shall not exceed 50 deg. F and for nearly all fuels should be lower than 40 deg. F

Furthermore, sulfur content of the fuels may be adjusted using a three-component sulfur mixture containing 4.3 mass % dimethyl disulfide, 22.8 mass % thiophene and 72.9 mass % benzothiophene. All blendstocks used in this program must be approved by the EPA WAM.

All ethanol-containing fuels shall be prepared using denatured ethanol meeting the requirements of ASTM D4806 standard. The properties of all ethanol-containing fuels shall be reported on a total sample basis, e.g. hydrocarbon type content by ASTM D1319 shall be corrected for ethanol content in the fuel. An oxidation inhibitor shall be added to all finished test fuels.

Hand blend inspection data for every test fuel shall be presented to the EPA WAM for review. Final blending shall not proceed unless authorized by the EPA WAM. Similarly, final blend inspection data generated by the blending laboratory (in the event that fuel blending will be subcontracted), and by the contractor, shall be forwarded to the EPA WAM for review prior to the shipment of these fuels for use in this test program. The shipment of the fuels to the contractor and their use in this program shall not proceed unless authorized by the EPA WAM. Once a fuel has been accepted for testing, a 5 gallon sample shall be shipped to EPA for use in an audit and/or a round robin program.

The contractor shall make sure that the quantities of test fuels blended include a reasonable safety margin in case some of the tests must be repeated and shall advise the EPA WAM about the magnitude of that margin. In addition, the blending subcontractor (if any) shall prepare 200 gallons (each) of fuels 17, 18, and 19 beyond what is needed for this program. The additional quantities of these fuels shall be shipped to EPA's facility in Ann Arbor, Michigan, when directed by the WAM.

Upon the receipt of test fuels, the contractor shall conduct a set of analyses listed in Table 4-1 on a single drum sample of each fuel. Additional analyses (to be determined) shall be conducted on a single drum sample of each fuel at the midpoint and at the end of the program to determine if any fuel properties have changed as a result of fuel storage and handling.

Table 4-1. Test Fuel Analyses

Fuel Property	Test Method
Relative Density	ASTM D4052
Ethanol	ASTM D5599
Total Oxygenates Other Than Ethanol	ASTM D5599
Distillation	ASTM D86
DVPE	ASTM D5191
Aromatics	ASTM D1319
Olefins	ASTM D1319
Benzene	ASTM D3606
Sulfur	ASTM D5453
RON	ASTM D2699
MON	ASTM D2700
Hydrogen	ASTM D4808 Method A
Oxygen	ASTM D5599
Net Heat of Combustion	ASTM D4809 Please also report C and H by ASTM D5291

The contractor shall utilize fuel storage and handling practices that will minimize, to the greatest extent possible, any changes in test fuel properties or mislabeling of fuel drums, or any other possible situations which could lead to misfueling of the test vehicles. These practices shall include the storage of test fuels in sealed 5B drums, indoors, at temperatures not exceeding 75°F Furthermore, to assure that no drums are mislabeled, the contractor shall confirm fuel properties listed in Table 4-2 using a Petrospec analyzer each time a new drum is opened. Additionally, unique alphanumeric labels assigned to individual drums shall be recorded each time a vehicle is fueled.

Table 4-2. Test Fuel Properties to Be Confirmed Using the Petrospec Analyzer

Ethanol Content of the Fuel, vol. %	Fuel Properties to Be Confirmed
0 – 15	Ethanol content, aromatic content, T90
> 15	Aromatic content, T90

Similarly, the contractor shall ensure that the fuel blending subcontractor (if any) will apply

equally stringent fuel storage and handling practices to finished test fuels waiting for shipment. The contractor shall describe the methods to be employed to minimize such changes, and recommend additional methods that would prevent changes in fuel properties during the test program.

The 5 gallon sample of each test fuel for shipment to the EPA as well as fuel samples needed to perform the analyses listed in Table 4-1 shall be taken by the contractor from drums cooled below 45°F and preferably placed on their sides. Care will be taken to avoid splashing of the fuels during sampling by making sure that the filling tube reaches to the bottom of each container being filled.

Task 5 Vehicle Preparation is changed as follows.

Vehicles shall undergo a thorough inspection before beginning the test preparation sequence. This includes inspection of the engine, transmission, axles, exhaust system and tires, and verification that no OBD2 faults are set. Photographs of exhaust system layout shall be taken. The contractor shall collect and record vehicle information described in Appendix C for entry into MSOD data tables.

Following the inspection, a single FTP test shall then be performed using a baseline fuel (TBD) with bag measurements of THC, NMHC, NO_x, CO, and PM emissions. The results of this initial test shall be submitted to the EPA WAM for review to determine the vehicle's acceptability as a candidate vehicle for the test program. If accepted by EPA, an approved candidate vehicle may begin mileage accumulation and/or preparations for testing as outlined below.

Each vehicle approved by the EPA WAM shall then undergo initial crankcase oil, oil filter and air filter replacement. Air filters shall only be replaced in used vehicles (vehicles with more than 4,000 odometer miles). Oil and air filters shall be procured by the contractor per manufacturer's recommendations. One of the EPA-supplied lubricants shall be used per the vehicle manufacturer's viscosity requirements.

If the procured vehicle is used (has more than 4000 miles on the odometer), the engine oil and oil filter shall be replaced a second time following a full engine warm-up. The lubricant level in the sump shall be allowed to stabilize and its level indicated on the dipstick shall be recorded. The vehicle shall then be driven 2,000 miles on non-oxygenated, commercial, 87 octane gasoline to condition the lubricant in preparation for the emissions test program. Mileage accumulation shall either be done on a chassis dynamometer using the Standard Road Cycle or the vehicle shall be driven primarily on local interstates at or below posted speed limits.

If the procured vehicle is new (less than 4,000 miles), it shall be driven to 4,000 odometer miles either by operating it on a mileage accumulation dynamometer using the Standard Road Cycle or the vehicle shall be driven primarily on local interstates at or below posted speed limits. The fuel shall be a non-oxygenated, commercial, 87 octane gasoline. At the 2,000 mile odometer reading, crankcase oil and oil filter shall be replaced a second time. To accommodate subsequent oil samples, the sump shall be overfilled by 12 oz. The vehicle shall then be driven to make sure that fresh oil and the remainder of used oil have mixed well in the sump and a 4 oz.

sample of oil shall be taken from the engine. The lubricant level in the sump shall be allowed to stabilize and its level indicated on the dipstick shall be recorded. Mileage accumulation will then resume and continue until odometer reading of 4,000 miles is attained.

The oil sample taken at 2,000 miles and all subsequent oil samples shall be shipped in biweekly batches to the following address:

Lubrizol Corporation
1275 Lloyd Road (Bldg 8)
Wicliffe, OH 44092
Attn: Dr. Ewa Bardasz

Following the second oil change, no engine oil shall be added to any test vehicle until the completion of the test program. Should engine oil level in any the test vehicle fall to the minimum mark on the dipstick anytime during this program, the contractor shall immediately notify EPA WAM.

Following mileage accumulation and lubricant conditioning, each new vehicle shall once again undergo thorough inspection of the engine, transmission, axles, exhaust system and tires, and verification that no OBD2 faults are set. At that time, the second 4 oz. engine oil sample shall be taken and shipped to Lubrizol. Used vehicles need not undergo this inspection a second time.

Additional 4 oz. engine oil samples shall be taken and shipped to Lubrizol following emissions testing of the 4^{th}, 14^{th} and 25^{th} fuel in the Phase 3 test sequence of each vehicle, assuming that fuels 1-16 and 20-28 will be tested in each vehicle as one set in a random order.

In the case of the four FFVs, the final oil sample shall be taken following emissions testing on E85 fuel (the last fuel tested in each FFV in Phase 3 of the program). At that time the oil level on the dipstick shall also be recorded.

All engine oil samples shall be taken from warmed up engines, preferably using a Vampire pump. The following information shall be recorded in program files and on the oil sample label to be attached to each sample taken:

- Date
- Test vehicle designation
- Odometer miles
- Designation of exhaust emissions test immediately preceding engine oil sampling, if applicable
- Test oil code

If any test vehicle is equipped with traction control, the contractor shall ensure that the latter is disabled either through an interior disable button or other method (remove power fuse to anti-lock brake system (ABS)), and place a placard in the vehicle indicating the method of disabling traction control if driver input is required.

Road load derivations to generate dyno set coefficients will be performed at 75°F once vehicles have completed mileage accumulation. The test weight (ETW) and target coefficients for each vehicle must be approved by the EPA WAM. For the purpose of this study, the agreed road load setting shall remain the same for all testing on a given vehicle including the cold temperature testing.

Task 6 Vehicle Testing

6.1 Basic Testing Protocol is changed as follows.

The basic testing protocol is the testing of the recruited vehicles across all the test fuels over the California Unified Cycle (LA92) as a three phase, cold start test at FTP ambient and load conditions. Limited testing shall also be done at 50°F. All tests on a given vehicle must be done using the same 48-inch single roll (or equivalent) electric chassis dynamometer. More than one such dynamometer may be used in this program. The same driver shall also be used for all tests on a given vehicle (for all test repeats and across all test fuels). The contractor may comment on the feasibility of these requirements and propose additional measures that will reduce test to test variability, such as multi-shift testing on fewer chassis dynamometers.

Prior to any emission test conducted in this program, the representative bulk oil temperature in the sump shall be stabilized within ±3°F of the nominal test temperature, 50±3°F or 75±3°F. The representative oil temperature is defined in 40 CFR Part 86.232-94.

During tests performed at FTP ambient conditions, intake air temperature and humidity shall be maintained at 75±2°F and 75±5 grains H_2O/lb dry air, respectively. During tests performed at 50°F, intake air temperature shall be maintained at 50±2°F. The contractor shall recommend the intake air humidity setting and tolerance for 50°F emission tests which must be approved by the WAM before 50°F testing can begin.

The emission test program shall be executed in the following sequence:

Phase 1: Fuels 17, 18 and 19 tested in all vehicles at 75°F

Phase 2: Fuels 17, 18 and 19 tested in all vehicles at 50°F

Phase 3: Fuels 1-16 tested in all vehicles at 75°F

In Phases 1 and 2 of the program, the test fuels shall be tested in each vehicle in the following sequence: Fuel 17 (E0) followed by fuel 18 (E10) and then fuel 19 (E15).

In Phase 3 of the program, the order in which the various test fuel and vehicle combinations are to be tested shall be randomized. However, replicate tests of a given fuel in a particular vehicle shall be done back-to-back. Specifically, the vehicle shall be tested twice (3 times if determined necessary per emissions variability criteria provided in Table 6.1-3 below) on a given fuel before moving on to the next test fuel in the matrix. This "back-to-back" testing eliminates the need to

repeat additional vehicle preps (steps 1-6 of Table 6.1-1, below) between each replicate test on a given fuel.

The EPA requests that Phase 1 test results be made available as early as possible in the second quarter of 2008. The contractor shall comment on the feasibility of launching and completing Phase 1 of this program in the most expeditious manner.

While it is preferable that Phase 2 of this program be completed immediately following Phase 1, it may also be carried out, as a block, shortly following the launch of Phase 3.

The sequence of events for the testing of an individual vehicle is summarized in Tables 3a and 3b. All vehicles shall be tested two or three times on each fuel at each test temperature (replicate tests). The need for a third test will be determined based on the variability of the previous two replicates (see step 14 in Table 6.1-1, below).

The emissions to be measured and reported are THC, NMHC (by FID), NMOG, NO_x, NO_2, CO, CO_2, ethanol, PM, speciated VOCs, N_2O, NH_3 and HCN. The contractor shall comment on the feasibility and cost of incorporating bag (phase) level measurement of ethanol emissions by means of INNOVA photoacoustic analyzer.

More specifically, the following exhaust emission measurements shall be made:

1. Bag (phase) level and composite THC, NMHC, NMOG, CO, CO_2, NO_x, NO_2, ethanol and PM emissions

2. Bag (phase) level speciated VOCs for a subset of tests (See Task 6.2, below). The list of compounds to be measured and analyzed is given in Appendix D Version 2

3. Continuous and integrated by bag (phase) emissions of the following species in raw exhaust: THC, NMHC, CO, CO_2 and NO_x

4. Continuous and integrated by bag (phase) emissions of the following species measured in raw exhaust for a subset of tests (see Task 6.3.2, below): N_2O, NH_3 and HCN

Light-duty FTP weighting factors shall be used to calculate composite emissions. In addition, the contractor shall report bag (phase) level and total test cycle work measured at the wheels.

During all emission tests, the contractor shall record the following OBD 2 parameters at the rate of 1 Hz using contractor-supplied data acquisition equipment:

- RPM
- Vehicle speed
- Engine load
- Short term fuel trim-bank 1

- Long term fuel trim-bank 1
- MIL status
- Absolute throttle position
- Engine coolant temperature
- Short term fuel trim-bank 2
- Long term fuel trim-bank 2
- Fuel/air commanded equivalence ratio
- Alcohol fuel percent
- Manifold absolute pressure
- Spark advance
- EGR
- Purge

The facilities for testing shall meet the requirements of 40 CFR Part 86 Subpart B and 40 CFR Part 86 Subpart C as they apply to vehicle exhaust testing. THC, NMHC, NMOG, NO_x, NO_2, CO, and CO_2, and PM emissions sampling and measurement shall be conducted as specified in 40 CFR 1065. The minimum detection limit for NO_2, measurements shall be 5 ppb. If some aspect of testing will need to be done in variance to the above specifications the contractor shall describe why that is the case and how it may impact the test results. Variances must be approved the EPA WAM before testing may begin. The methodology to be used for determining NMHC and NMOG emissions is described in the CARB document "California Non-Methane Organic Gas Test Procedures[i]"

The contractor shall recommend sample collection and analytical methods for non-standard emission measurements. These recommendations will take into account analytical detection limits, emission rates expected of Tier 2 vehicles and the requirement to collect all samples in the course of a single LA92 test. All sample collection and analytical methods related to non-standard emission measurements must be approved by the EPA WAM.

The contractor shall provide a separate cost estimate for "blank" LA92 tests that would be conducted periodically during Phases 1, 2 and 3 of this program. These tests will involve running the full test sequence drawing only background air into the sampling system. All sampling systems will be operated and measurements will include:

- Phase level THC, CH4, CO, NOx, CO2, PM, ethanol by INNOVA, NO2, VOCs (including aldehydes and alcohols)
- Continuous THC, NMHC, CO, NOx, CO2, N2O, NH3, and HCN

Two such tests, spaced one week apart, shall be performed at the outset of Phase 1 followed by another test one month later. One "blank" LA92 test shall be conducted at the start of Phases 2 and 3 followed by additional such tests at one month intervals.

6.2 Speciation of Volatile Organic Compounds (VOCs) is changed as follows.

VOC speciation shall include C1-C12 hydrocarbons as well as light alcohols, and carbonyls. Sampling and analysis of C2-C12 hydrocarbons will be done using CARB method 1002/1003, "Procedure for the Determination of C2-C12 Hydrocarbons in Automotive Exhaust Samples by Gas Chromatography". Sampling and analysis of alcohols will be done using CARB method 1001, "Determination of Alcohols in Automotive Source Samples by Gas Chromatography". Sampling and analysis of carbonyl compounds will be done using CARB method 1004, "Determination of Aldehyde and Ketone Compounds in Automotive Source Samples by High Performance Liquid Chromatography".

During the analysis of C2-C4 hydrocarbons, special consideration shall be given to 1,3-butadiene. Because of the instability of 1,3-butadiene the analysis of C2 – C4 hydrocarbon samples collected during phase 1 of the test cycle shall be initiated within one hour of collection. The speciation of C5-C12 hydrocarbon samples collected in phase 1 of the test cycle shall be completed within 4 hours of collection. The time between sample collection and the start of C2-C4 and C5-C12 hydrocarbon analysis shall be reported. The contractor shall make every effort to complete the analysis of C2-C4 and C5-C12 background hydrocarbon samples on the day they are collected.

Alcohol samples shall be sealed and stored at a temperature below 40°F immediately following collection. The contractor shall make every effort to analyze these samples on the day they are collected, but no later than within six calendar days.

Samples of carbonyl compounds shall be collected in cartridge type samplers. These samples shall be extracted immediately following collection (within 15 minutes) and the extracts sealed and stored immediately at a temperature below 40°F. The contractor shall make every effort to analyze these extracts on the day they are collected, but no later than within three calendar days. This analysis shall account for the presence of a tautomer of acrolein, acrolein-x in the sample. To this end, the contractor shall establish the location of the acrolein-x peak in the HPLC chromatogram and using the response factors derived from the calibration for acrolein, quantify and report acrolein-x mass emissions.

The contractor shall apply the following daily sequence to vehicle testing:

- All vehicles requiring VOC sampling only during phase 1 of the test cycle shall be tested first

- Any vehicle requiring VOC sampling during all three phases of the test cycle shall be tested last. No more than one such vehicle shall be tested per test day, unless the contractor can demonstrate that the total number of vehicles tested on that day and the timing of their tests will not compromise the time limit requirements imposed on sample analyses

The contractor shall also apply the following daily sequence to the analysis of VOC samples:

- VOC samples collected in phase 1 of the test cycle shall be analyzed first, in the sequence of vehicle tests

- If a vehicle requiring VOC sampling during all three phases of the test cycle is tested, the contractor shall analyze the phase 1 sample first, followed immediately by the phase 3 sample and finally by the phase 2 sample.

- Background samples shall be analyzed last, in the sequence of vehicle tests

The VOCs to be analyzed are identified in Appendix D Version 2. The contractor shall comment on the feasibility of these requirements and propose additional measures to improve the precision of VOC speciation. All methods used in the measurement of VOCs must be approved by EPA WAM.

In Phases 1, 2 and 3 of the program, VOC speciation shall be performed for all 3 test phases of the LA92 cycle, on all fuels (3 fuels in Phases 1 and 2, and 16 fuels in Phase 3), for a subset of 3 vehicles (vehicles to be selected by the EPA WAM). This includes all repeat tests, and is outlined graphically in Table 6.2-1, below.

Table 6.2-1: VOC Speciation Summary for 3 Vehicles in Program Phases 1, 2 and 3

	LA92 Test Repeat		
LA92 Test Phase (bag)	**1**	**2**	**3**
1	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls
2	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls
3	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls

The remaining 16 vehicles shall only require VOC speciation in phase 1 of the LA92 test, also for all test fuels (3 fuels in Phases 1 and 2, and 16 fuels in Phase 3). This also includes all repeat tests and is outlined in Table 6.2-2, below.

Table 6.2-2: VOC Speciation Summary for 16 Vehicles in Program Phases 1, 2 and 3

	LA92 Test Repeat		
LA92 Test Phase (bag)	**1**	**2**	**3**

1	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls	C1-C12 Speciation Alcohols Carbonyls
2	none	none	none
3	none	none	none

The CARB procedure for calculating NMHC and NMOG (mentioned above and referenced at the end of this document) shall be followed. Phase-level NMOG shall be calculated for all phases where the required measurements are available (i.e. NMHC, carbonyls, and light alcohol measurements are made). In cases where one or more components of the phase-level NMOG calculation is not measured (for example, when carbonyls are not measurement in phases 2 and 3 of some tests) the contractor shall calculate phase-level NMOG mass emissions assuming the missing measurements are below method detection limits. These phase-level NMOG calculations shall then be used to calculate composite weighted NMOG mass emissions. In all cases, the contractor shall report all measured phase-level NMOG components (i.e. each compound quantified) separately along with the associated FID response factors used in NMOG and NMHC determination.

6.3 Continuous Measurements of Gaseous Emissions in Raw Exhaust

6.3.2 Continuous N_2O, NH_3 and HCN is changed as follows:

Continuous and integrated by bag (phase) emissions of N_2O, NH_3 and HCN shall be measured using Fourier Transform Infrared Spectroscopy (FTIR) or an alternate method proposed by the contractor and approved by the EPA WAM.

The measurements of N_2O, NH_3 and HCN emissions shall be performed on the first test of each fuel/vehicle combination in Phases 1 and 2 of this program and for the first test on each of the FFVs on E85 in Phase 3. No repeat measurements are required.

Task 7 Deliverables

7.1 Weekly Reports is changed as follows:

The contractor shall provide 30-60 minute telephone conference reports weekly that summarize progress to date. Weekly test results in spreadsheet form shall be provided to the EPA WAM.

The oral report shall indicate progress achieved in the preceding week, technical issues encountered, solutions to issues (proposed or attempted), and projected activity in the following week. This report shall include any potential issues or circumstances that arise causing any delays in

the testing. The WAM or his/her designated alternate shall participate in these phone conferences.

The contractor shall provide on a weekly basis to the WAM a report summarizing hours and dollars expended on the Tasks in the PWS. In Task 6, this report shall be prepared separately for each of the three phases of the test program. The goal of the report is to identify as early as possible if costs in hours and dollars are exceeding that which has been budgeted for the program by EPA and scheduled by the contractor.

Work Assignment Manager (WAM)	Constance Hart, 734/ 214-4340
Alternate WAM	Rafal Sobotowski, ASD 734/214-4228
Technical Contacts	Michael Christianson, ASD 734/214-4624 Antonio Fernandez, ASD 734/214-4431 Carl Fulper, ASD 734/214-4400 Aron Butler, ASD 734/214-4011

The above Technical Contracts are able to communicate with the contractor. However it will be technical communication vice technical direction. Per the technical direction clause EPAAR 1552.237-71 of the contract, the PO and the WAM or alternate WAM are the primary representatives of the CO authorized to provide technical direction.

---

[i] "California Non-Methane Organic Gas Test Procedures". Amended version, July 30, 2002. Available online at the California Air Resources Board website: http://www.arb.ca.gov/msprog/levprog/cleandoc/clean_nmogtps_final.pdf.

Appendix D Version 2
Speciated VOC needed from EPAct testing

CAS	NAME	SPEC_MW
74-82-8	Methane	16.04246
74-86-2	Acetylene	26.03728
74-85-1	Ethylene	28.05316
50-00-0	Formaldehyde	30.02598
74-84-0	Ethane	30.06904
67-56-1	Methyl alcohol	32.04186
463-49-0	1,2-propadiene	40.06386
74-99-7	1-propyne	40.06386
115-07-1	Propylene	42.07974
75-07-0	Acetaldehyde	44.05256
74-98-6	Propane	44.09562
64-17-5	Ethyl alcohol	46.06844
106-99-0	1,3-butadiene	54.09044
107-02-8	Acrolein (2-propenal)	56.06326
106-98-9	1-butene	56.10632
107-01-7	2-Butene	56.10632
115-11-7	Isobutylene	56.10632
590-18-1	Cis-2-butene	56.10632
624-64-6	Trans-2-butene	56.10632
123-38-6	Propionaldehyde	58.07914
67-64-1	Acetone	58.07914
106-97-8	N-butane	58.1222
75-28-5	Isobutane	58.1222
142-29-0	Cyclopentene	68.11702
4170-30-3	Crotonaldehyde	70.08984
109-67-1	1-pentene	70.1329
287-92-3	Cyclopentane	70.1329
513-35-9	2-methyl-2-butene	70.1329
563-45-1	3-methyl-1-butene	70.1329
563-46-2	2-methyl-1-butene	70.1329
627-20-3	Cis-2-pentene	70.1329
123-72-8	Butyraldehyde	72.10572
78-93-3	Methyl ethyl ketone (2-butanone)	72.10572
109-66-0	N-pentane	72.14878
463-82-1	2,2-dimethylpropane	72.14878
78-78-4	Isopentane	72.14878
71-43-2	Benzene	78.11184
110-83-8	Cyclohexene	82.1436
1120-62-3	3-methylcyclopentene	82.1436
693-89-0	1-Methylcyclopentene	82.1436
110-82-7	Cyclohexane	84.15948
13269-52-8	Trans-3-hexene	84.15948
4050-45-7	Trans-2-hexene	84.15948
592-41-6	1-hexene	84.15948
625-27-4	2-methyl-2-pentene	84.15948

674-76-0	4-methyl-trans-2-pentene	84.15948
691-37-2	4-methyl-1-pentene	84.15948
760-20-3	3-methyl-1-pentene	84.15948
763-29-1	2-methyl-1-pentene	84.15948
7642-09-3	Cis-3-hexene	84.15948
7688-21-3	Cis-2-hexene	84.15948
922-61-2	3-methyl-2-pentene	84.15948
96-37-7	Methylcyclopentane	84.15948
590-86-3	Isovaleraldehyde	86.1323
107-83-5	2-methylpentane	86.17536
110-54-3	N-hexane	86.17536
75-83-2	2,2-dimethylbutane	86.17536
79-29-8	2,3-dimethylbutane	86.17536
96-14-0	3-methylpentane	86.17536
1634-04-4	Methyl t-butyl ether	88.14818
108-88-3	Toluene	92.13842
10574-37-5	2,3-dimethyl-2-pentene	98.18606
108-87-2	Methylcyclohexane	98.18606
14686-13-6	Trans-2-heptene	98.18606
14686-14-7	Trans-3-heptene	98.18606
4038-04-04	3-Ethylpentene	98.18606
1638-26-2	1,1-dimethylcyclopentane	98.18606
1640-89-7	Ethylcyclopentane	98.18606
1759-58-6	Trans-1,3-dimethylcyclopentane	98.18606
2532-58-3	Cis-1,3-dimethylcyclopentane	98.18606
2738-19-4	2-methyl-2-hexene	98.18606
3899-36-3	3-methyl-trans-3-hexene	98.18606
6443-92-1	Cis-2-heptene	98.18606
7385-78-6	3,4-dimethyl-1-pentene	98.18606
816-79-5	3-ethyl-2-pentene	98.18606
108-08-7	2,4-dimethylpentane	100.20194
142-82-5	N-heptane	100.20194
464-06-2	2,2,3-trimethylbutane	100.20194
562-49-2	3,3-dimethylpentane	100.20194
565-59-3	2,3-dimethylpentane	100.20194
589-34-4	3-methylhexane	100.20194
590-35-2	2,2-dimethylpentane	100.20194
591-76-4	2-methylhexane	100.20194
617-78-7	3-ethylpentane	100.20194
994-05-8	T-amylmethylether	102.17476
100-42-5	Styrene	104.14912
100-52-7	Benzaldehyde	106.12194
100-41-4	Ethylbenzene	106.165
108-38-3; 106-42-3	M & p-xylene	106.165
95-47-6	O-xylene	106.165
107-39-1	2,4,4-trimethyl-1-pentene	112.21264
111-66-0	1-octene	112.21264
13389-42-9	Trans-2-octene	112.21264
16747-50-5	1,1-Methylethylcyclopentane	112.21264

16883-48-0	trimethylcyclopentane	112.21264
18679-30-6	Cyclopentane	112.21264
2207-01-4	Cis-1,2-dimethylcyclohexane	112.21264
2207-04-7	Trans-1,4-dimethylcyclohexane	112.21264
2613-65-2	ethylcyclopentane	112.21264
2815-57-8	1,2,3-trimethylcyclopentane	112.21264
3875-51-2	Cyclopentane, (1-methylethyl)-	112.21264
590-66-9	1,1-dimethylcyclohexane	112.21264
638-04-0	Cis-1,3-dimethylcyclohexane	112.21264
7642-04-8	Cis-2-octene	112.21264
111-65-9	N-octane	114.22852
540-84-1	2,2,4-trimethylpentane	114.22852
563-16-6	3,3-dimethylhexane	114.22852
565-75-3	2,3,4-trimethylpentane	114.22852
583-48-2	3,4-dimethylhexane	114.22852
584-94-1	2,3-dimethylhexane	114.22852
589-43-5	2,4-dimethylhexane	114.22852
589-53-7	4-methylheptane	114.22852
589-81-1	3-methylheptane	114.22852
590-73-8	2,2-dimethylhexane	114.22852
592-13-2	2,5-dimethylhexane	114.22852
592-27-8	2-methylheptane	114.22852
496-11-7	Indan	118.1757
620-23-5	Tolualdehyde	120.14852
103-65-1	N-propylbenzene	120.19158
108-67-8	1,3,5-trimethylbenzene	120.19158
526-73-8	1,2,3-trimethylbenzene	120.19158
611-14-3	1-Methyl-2-ethylbenzene	120.19158
620-14-4	1-Methyl-3-ethylbenzene	120.19158
622-96-8	1-Methyl-4-ethylbenzene	120.19158
95-63-6	trimethylbenzene)	120.19158
98-82-8	Isopropylbenzene (cumene)	120.19158
124-11-8	1-nonene	126.23922
7667-58-5	trimethylcyclohexane	126.23922
91-20-3	Naphthalene	128.17052
1068-19-5	4,4-dimethylheptane	128.2551
1069-53-0	2,3,5-trimethylhexane	128.2551
1071-26-7	2,2-dimethylheptane	128.2551
1072-05-5	2,6-dimethylheptane	128.2551
111-84-2	N-nonane	128.2551
2213-23-2	2,4-dimethylheptane	128.2551
2216-30-0	2,5-dimethylheptane	128.2551
2216-33-3	3-methyloctane	128.2551
2216-34-4	4-methyloctane	128.2551
3074-71-3	2,3-dimethylheptane	128.2551
3221-61-2	2-methyloctane	128.2551
3522-94-9	2,2,5-trimethylhexane	128.2551
922-28-1	3,4-dimethylheptane	128.2551
926-82-9	3,5-dimethylheptane	128.2551

105-05-5	1,4-diethylbenzene (para)	134.21816
1074-17-5	1-Methyl-2-npropylbenzene	134.21816
135-98-8	(1-Methylpropyl)benzene	134.21816
141-93-5	1,3-diethylbenzene (meta)	134.21816
1758-88-9	1,4-dimethyl-2-ethylbenzene	134.21816
2870-04-4	1,3-dimethyl-2-ethylbenzene	134.21816
488-23-3	1,2,3,4-tetramethylbenzene	134.21816
527-53-7	1,2,3,5-tetramethylbenzene	134.21816
527-84-4	1-Methyl-2-isopropylbenzene	134.21816
535-77-3	1-Methyl-3-isopropylbenzene	134.21816
538-93-2	(2-methylpropyl)benzene	134.21816
874-41-9	1,3-dimethyl-4-ethylbenzene	134.21816
933-98-2	1,2-dimethyl-3-ethylbenzene	134.21816
934-74-7	1,3-dimethyl-5-ethylbenzene	134.21816
934-80-5	1,2-dimethyl-4-ethylbenzene	134.21816
95-93-2	1,2,4,5-tetramethylbenzene	134.21816
99-87-6	1-Methyl-4-isopropylbenzene	134.21816
124-18-5	N-decane	142.28168
15869-87-1	2,2-dimethyloctane	142.28168
4032-94-4	2,4-dimethyloctane	142.28168
7146-60-3	2,3-dimethyloctane	142.28168
1074-92-6	t-1-Butyl-2-Methylbenzene	148.24474
1595-11-5	1-Methyl-2-n-butylbenzene	148.24474
16021-20-8	1-ethyl-2-npropylbenzene	148.24474
538-68-1	N-pentylbenzene	148.24474
1120-21-4	N-undecane	156.30826
112-40-3	N-dodecane	170.33484